Institute for Materials Science

UNCLASSIFIED

2016 IMS Summer School: Los Alamos Science Capabilities

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Ultrafast Science: Quicker than a Blink of the Eye

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2:00 PM
Physics Auditorium (TA-03 - Bldg 215 - Room 182)

The IMS Summer School focuses on Science Capabilities at Los Alamos National Laboratory and is designed to expose our visitors to the broad range of great science performed at the Lab. Through the course of **seven talks** and **four site visits**, students will have a unique opportunity to learn about LANL directly from our top scientists and participate in facility tours.

Abstract: All around us, there are processes occurring on timescales we're completely unaware of. For example, when sunlight hits our skin, we feel warm within a few seconds; few of us know that this light-to-heat conversion actually happens within a few trillionths of a second (picoseconds), even if we don't feel it that quickly. Similarly, electrons in the ubiquitous electronic devices we carry with us can travel short distances at speeds of thousands of meters/second, which set the ultimate speeds achievable in our cellphones and computers. Finally, chemical reactions, like the fundamental processes involved in vision, can occur on even faster timescales of femtoseconds (a thousandth of a picosecond). The bottom line is that in the materials all around us, atoms and electrons are continually moving on these timescales of less than a trillionth of a second, and these "ultrafast" processes have a significant impact on our daily lives. As a result, understanding events that happen at ultrafast timescales is important, because they underlie many of the technologies, and even natural processes, that we interact with every day.

Not surprisingly, one might think that it is impossible to measure events at these timescales, and indeed, with even the fastest electronics it can't be done. However, in the 1970s and 1980s scientists developed lasers that could generate sub-picosecond pulses of light, enabling them to gain insight into these ultrafast processes. Since then, ultrafast optical techniques have been used to unravel chemical reactions, track electrons moving through solids, and shed light on fundamental biological processes. Equally important, but perhaps less known, is the fact that these methods can provide insight into not only dynamic, but static properties of materials, including their electronic, transport, and thermal properties.

In this talk, I will give an overview of ultrafast science, starting with ultrafast processes that occur in nature, moving on to explain how we can generate and use ultrashort pulses of light to measure these processes, and ending with some contemporary examples of cutting edge ultrafast science.

Bio: Rohit Prasankumar is a technical staff member in MPA-CINT. He has been at LANL since 2003, after completing his undergraduate work at the University of Texas at Austin and his graduate work at MIT. His research primarily focuses on the measurement of dynamics in complex materials, such as multiferroics, Dirac materials, and semiconductor nanowires, with high temporal and spatial resolution over a broad spectral range.

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